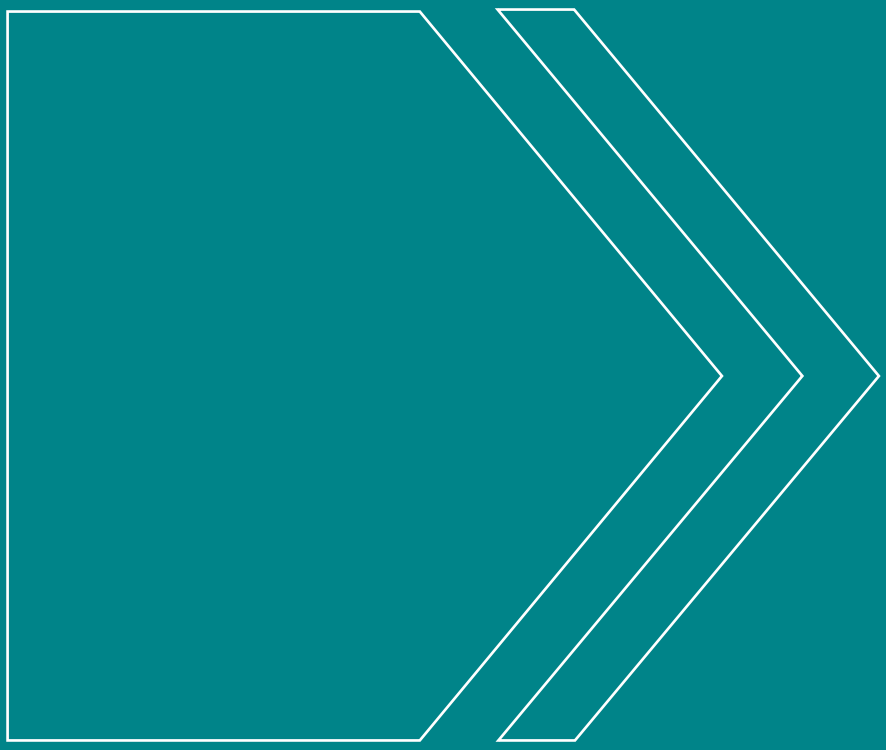
Energy Advanced

PROJECT OF ENERGY RETROFIT OF BUILDINGS IN LJUBLJANA
2022

City of Ljubljana

LJUBLJANA winner 2016 EUROPEAN GREEN CAPITAL

EUROPEAN UNION
COHESION FUND
INVESTING IN YOUR FUTURE



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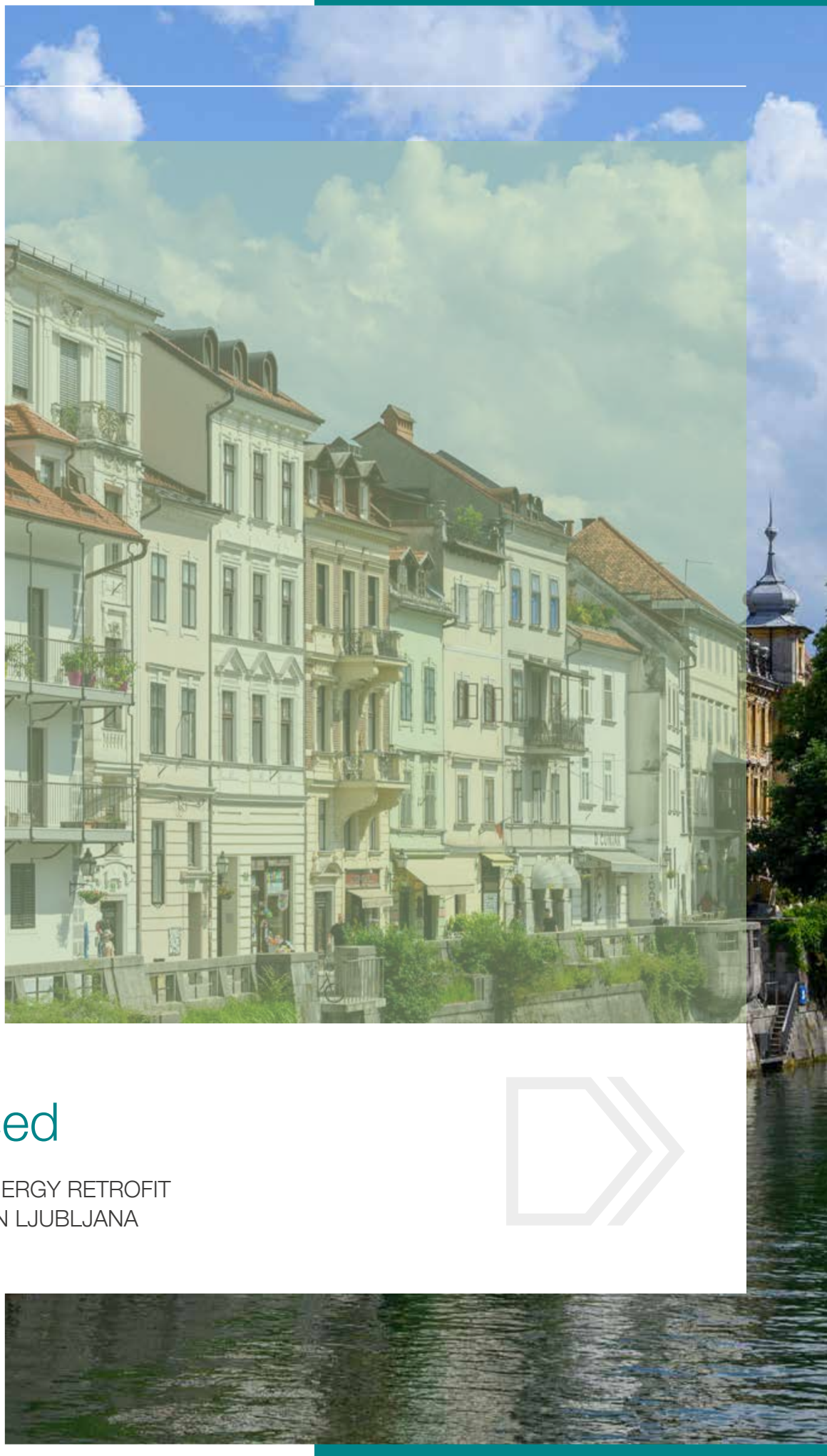

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OF BUILDINGS IN LJUBLJANA
2022

Address by Mayor Zoran Janković

Energy-retrofitted buildings for a higher quality of living

In Ljubljana, we are continuing the project of energy retrofit of buildings, with which we have been taking care of the environment since 2017, increasing the quality of living in the renovated buildings, and at the same time reducing the consumption of energy sources, which is all the more important during the energy crisis.

This time, we present you the fourth publication on the project of the Energy Retrofit of Ljubljana, which takes place within the framework of a public-private partnership with a consortium of companies Petrol and Resalta. I am proud that, together with our partners, we demonstrate a high level of social responsibility towards the environment in which we live and work.

In this part of the project, too, we focused on the renovation of the buildings of primary schools and kindergartens, because we want to enable the next generations to spend their time in kindergartens and schools in a way as pleasant as possible and in premises that are friendly to both the environment and users.

In Ljubljana, we implement a number of projects and measures to respond to the challenges of the future, one of which is undoubtedly climate change. With the building energy retrofit project, we have so far saved almost 19 million kWh, or in other words, we have preserved more than 230,000 trees or 532 hectares of forest areas.

I am happy that our work is also recognised in the international environment. Recently, I have been particularly proud of the fact that Ljubljana has been ranked at the very top of the list of the green capitals of Europe so far, and this year we also hold the title of the best destination in Europe, which was awarded to us by travellers from all over the world.

Ljubljana is also greener and more sustainable thanks to a project such as energy retrofit of buildings. Together we are building an open, solidary, tolerant and friendly city in which we nurture a high quality of life!

Zoran Janković
Mayor of the City of Ljubljana

Address by the Energy Manager Petra Šeme

Energy efficiency first, then renewable energy sources

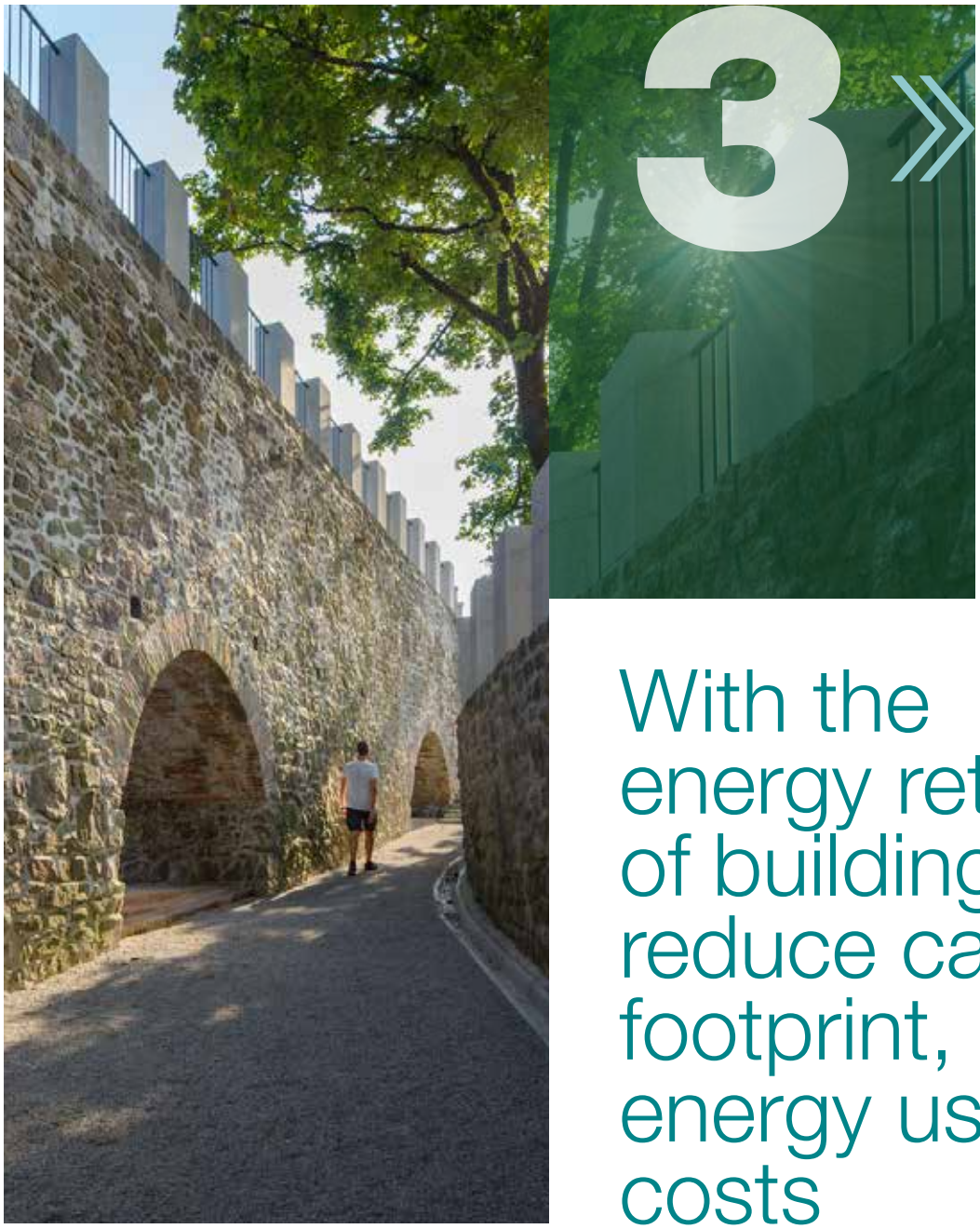
With energy retrofits, the City of Ljubljana pursues national and European goals for reducing energy consumption and increasing the share of renewable energy sources. I am proud to be part of the project, within the framework of which we have already renovated 82 buildings, 47 comprehensively and 35 partially.

In front of you is the fourth brochure with which we present the EOL (Energy Retrofit of Ljubljana) project, within the framework of which we completed the comprehensive energy retrofit of 8 buildings and the partial energy retrofit of 5 buildings in 2022. For comprehensive energy retrofits, we obtained grants from the Cohesion Fund in the amount of 49% of the investment value. Most of the buildings were comprehensively retrofitted with additional input from the City of Ljubljana, including measures to ensure structural integrity and fire safety.

The public-private partnership based on the principle of energy contracting is a 15-year project, and with the completed energy retrofits, the essence of the project is just beginning: achieving the highest possible energy savings. Energy savings will be monitored through a central control system, which in addition to monitoring also enables efficient energy management.

In times of energy crisis and high energy prices, the EOL project is even more important than before. I look forward to continuing the EOL project in the future.

Petra Šeme
Energy Manager



3»

With the energy retrofits of buildings, we reduce carbon footprint, energy use and costs

In 2022, we completed the second part of the third set of energy retrofits of buildings with the energy renovation of 13 buildings owned by the City of Ljubljana. We comprehensively retrofitted 7 school buildings and 1 kindergarten. We partially retrofitted 2 primary schools and 3 kindergartens, and we also comprehensively renovated all kindergartens with our own funds.

The total investment of the energy retrofits amounts to almost 9 million euros, with the private partner (partnership of Petrol PLC and Resalta Ltd.) financing 51% of the total value, and 3.6 million euros from the Cohesion Fund.

At the expense of the implemented energy-saving building renovation measures, we will save over 3,000 MWh annually, which amounts to approximately 550,000 euros annually. We carried out all energy retrofits at the required quality level and used the best materials. The energy contracting approach provides servicing, maintenance and a guarantee for installed materials and equipment for a period of 15 years.

> In addition to the implemented energy-saving building renovation measures, all facilities also have a central control system installed, which enables remote management of energy systems and monitoring of the facility's energy consumption and possible anomalies, which is the foundation for calculating and proving savings.

This year's range of facilities includes educational institutions, which demonstrates that we pay special attention to our youngest.

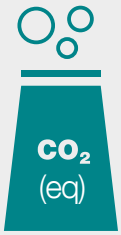
In the current social and economic situation, when energy prices are rising and every saved kWh means a lot, the importance of the EOL project, within the framework of which we have so far renovated a total of 82 buildings, is even higher. Increasing the share of renewable energy sources follows national and international goals and enables the diversification of energy sources.

13
energy retrofitted
buildings

We included 13 public buildings in the energy retrofits project. We performed a comprehensive energy retrofit at 8 facilities and obtained cohesion grants for them. On the remaining 5 facilities, we carried out a partial energy retrofit.

3,000 MWh
Guaranteed annual savings
(electric energy and heat)

EUR 550,000



500 tonnes less emissions

This is the amount absorbed per year by **24,000** average-sized trees.

Map of the retrofits

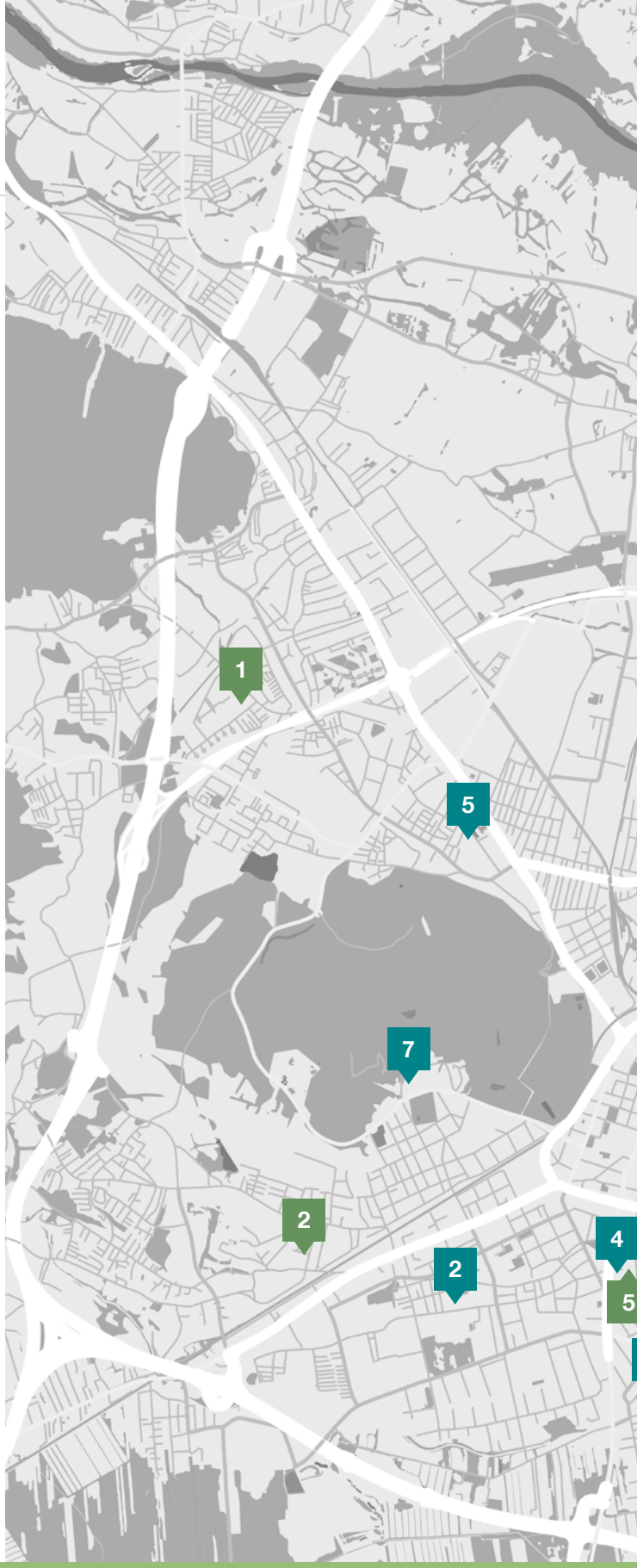
Public-private partnership based on the principle of energy performance contracting – PPP EP EOL 3

Comprehensive energy retrofits of buildings

1. Janez Levec Centre Ljubljana – Karlovška
2. Kolezija Primary School, location Splitska
3. Martin Krpan Primary School
4. Trnovo Primary School
5. Rihard Jakopič Primary School
6. Zalog Primary School
7. Vič Kindergartens – Rožna dolina branch
8. Livada Primary School

Partial energy retrofits of buildings

1. Miško Kranjec Primary School
2. Vič Primary School
3. Pedenjped Kindergarten – Učenjak Branch
4. Šentvid Kindergarten – Sapramiška Branch
5. Trnovo Kindergarten

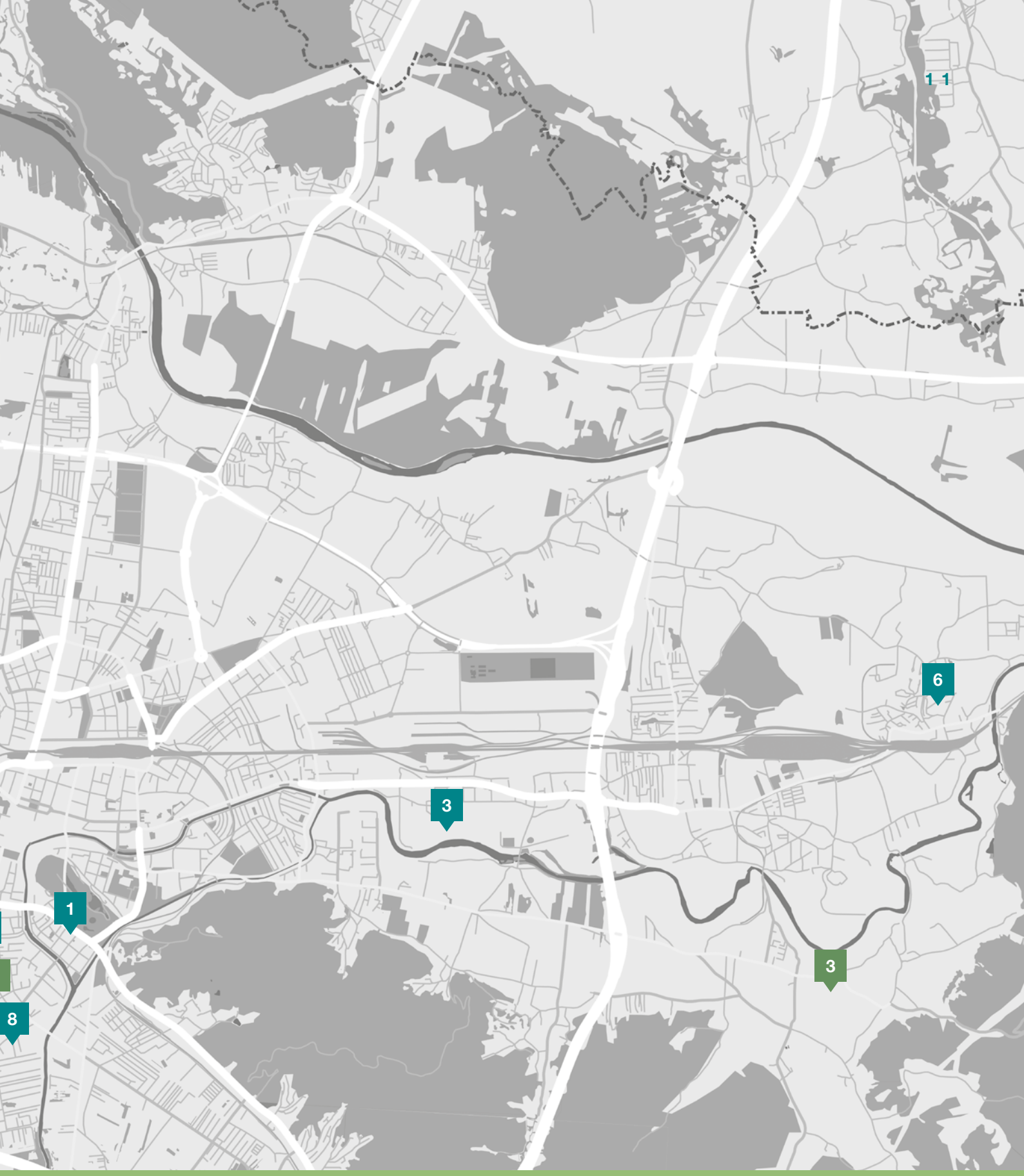


15,298 m² of building envelope on 8 buildings.

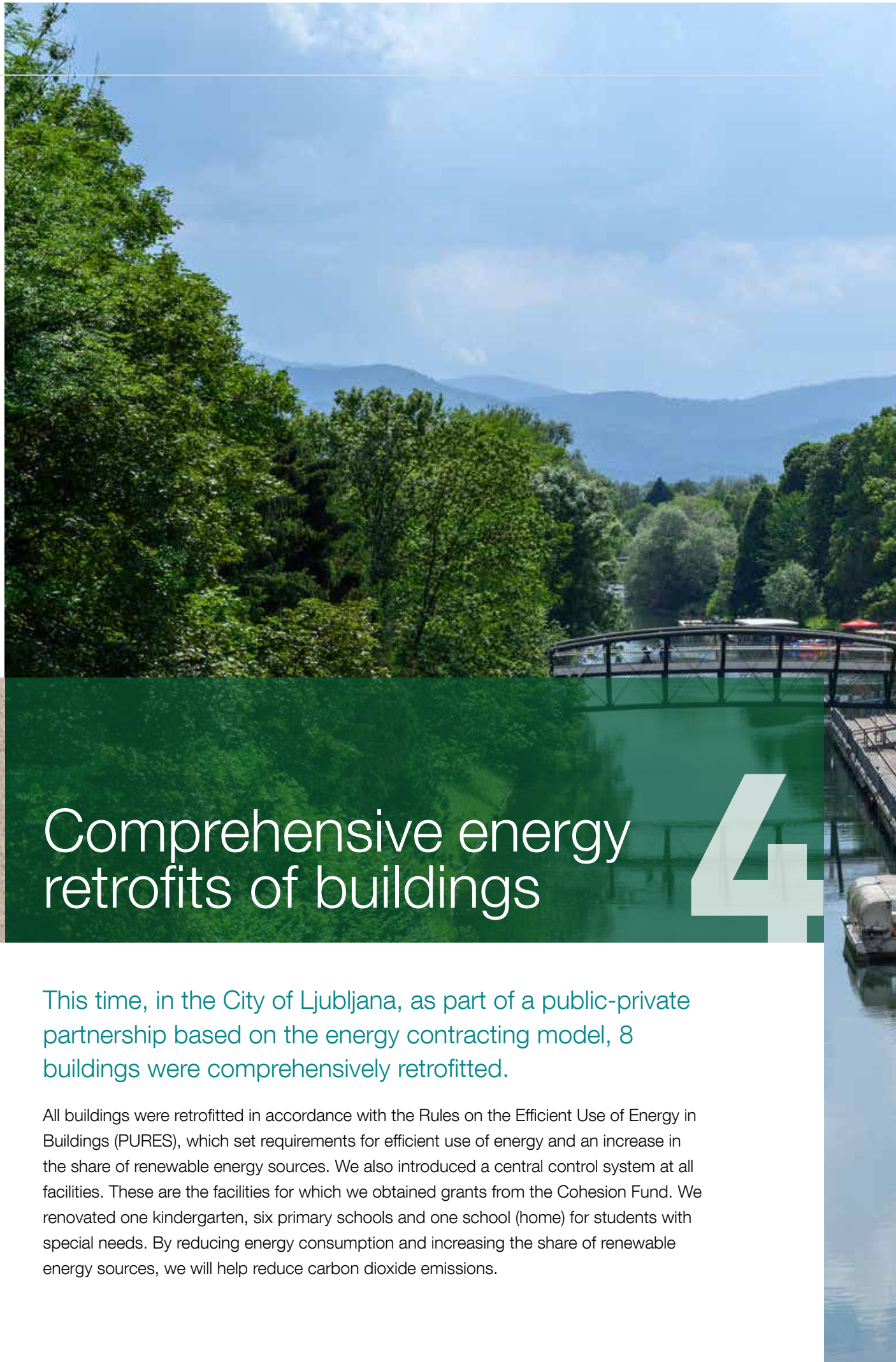
3,138 m² of windows and doors on 8 buildings.

Installation of thermal insulation of the roof or attic on

13,237 m² on 8 buildings.



- Renovation of heating sources with **the installation of 11 heat pumps** at **13 facilities,** renovation of **2 thermal stations for district heating.**
- Renovation of the interior lighting of buildings with the installation of more than **5,412 replaced lamps.**
- Installation of **1,827 thermostatic valves.**



Comprehensive energy retrofits of buildings

4

This time, in the City of Ljubljana, as part of a public-private partnership based on the energy contracting model, 8 buildings were comprehensively retrofitted.

All buildings were retrofitted in accordance with the Rules on the Efficient Use of Energy in Buildings (PURES), which set requirements for efficient use of energy and an increase in the share of renewable energy sources. We also introduced a central control system at all facilities. These are the facilities for which we obtained grants from the Cohesion Fund. We renovated one kindergarten, six primary schools and one school (home) for students with special needs. By reducing energy consumption and increasing the share of renewable energy sources, we will help reduce carbon dioxide emissions.

8
comprehensively
retrofitted buildings

7,400,000
EUR
Investment value

28,000
m²
total renovated area

CO_2 (eq)

380 tonnes less emissions

18,000
average-sized trees

Comprehensive energy retrofits of buildings

Janez Levec Centre Ljubljana – Karlovška

Name	Janez Levec Centre Ljubljana – Karlovška
Address	Karlovška cesta 18, 1000 Ljubljana
Year of construction	1900

As part of the Energy Retrofit of Ljubljana project, we comprehensively retrofitted the building.

Baseline

The ceiling towards the attic of the building was insufficiently insulated. The gas boiler and heating system needed renovations, the radiator heating allowed for local regulation, but without thermostatic valves and hydraulically unbalanced. The lighting was mostly done in fluorescent technique with classic ballasts.

The building is under cultural protection.

Start of works: July 2021

Completion of works: January 2022

Investment value: € 418,236.50

today

Implemented measures of comprehensive energy retrofit

Thermal insulation: We carried out thermal insulation of the wall and ceiling towards the attic.
Ventilation: We energy-retrofitted the ventilation in the kitchen with the installation of a new ventilation system.
Heating system: We replaced the old natural gas boiler with new condensing boilers and an air-to-water heat pump with all associated hydraulic equipment. New thermostatic valves and heads were installed on the radiator heating and the heating system was hydraulically balanced.
Lightning renovation: We replaced all the older, energy-wasting lighting with the new one in LED technology. We replaced 396 lamps, upgraded 25 sensors for turning on the lights, and upgraded the DALI system for smart lighting control in 40% of the facility.
Energy management: We introduced energy monitoring at the facility, through which we monitor the energy consumption in the facility and thus the achievement of the set goals (savings).

The facility at Karlovška 18 in Ljubljana houses the premises of the two organisational units of the Janez Levac Centre, the Home and the Administration. As the head of the House, I strive to ensure that the house is in order and that we preserve the atmosphere of the past, which is visible at every step, as the house is almost 200 years old.
When I learned from the principal Matej Rovšek, PhD, that the house was on the list for energy retrofitting, I was happy and worried at the same time.
All my worries quickly dissipated when I met the team that managed and supervised the rehabilitation.
Of course, sometimes something got stuck, but we solved every problem with good will and conversation.

***Irena Nose**, head of the branch office Dom Janez Levec Centre*

Contractually guaranteed results

Baseline: 188.46 kWh/m^{2}a
Condition after the renovation: we lowered the energy number to 144.56 kWh/m^{2}a

Comprehensive energy retrofits of buildings

Kolezija Primary School, location Splitska

Name	Kolezija Primary School, location Splitska
Address	Splitska ulica 13, 1000 Ljubljana
Year of construction	1965

As part of the Energy Retrofit of Ljubljana project, we comprehensively retrofitted the building.

Baseline

The building envelope of the facility, the ceiling above the attic and the flat roofs were insufficiently insulated, and old wooden and PVC builders' joinery was installed. The gas boiler station needed renovation and replacement of the energy source, the radiator heating allowed for local regulation, but it was hydraulically unbalanced. The lighting was mostly done in fluorescent technique with classic ballasts.

The building was in a poor state of energy efficiency.

Start of works: June 2021

Completion of works: December 2021

Investment value: € 1,248,436.80

today

Implemented measures of comprehensive energy retrofit

Building envelope: We thermally insulated the building facades, which have not yet been rehabilitated in a short time, with an insulation material thickness to meet the requirements of Regulations. The gym and the extension with the library already had the appropriate thickness of thermal insulation material.
Insulation of the facade below the ground: We removed the floors, installed waterproofing and XPS, and reinstalled the cleaned exterior floors.
Builders' joinery: We replaced the old energy-wasting joinery with new one and installed manually operated external blinds. We installed new PVC windows, in accordance with the Regulation. For larger fixed glazing, we installed joinery with ALU frames.
Roof insulation: We thermally insulated the school's flat roof. We installed thermal insulation on the ceiling towards the attic and the flat roof over the house and its extension and the connecting corridor.
Heating system: We installed a water-to-water heat pump, which is the primary source of heating. A redundant and peak source is the cascade connection of wall-mounted gas condensing boilers. The heating of sanitary water was accomplished through two storage tanks. Outside the facility, in accordance with the previously conducted hydrogeological research and the executive design of the wells, we constructed a pumping well with the extraction of underground water. New thermostatic valves and heads were installed on the radiator heating and the heating system was hydraulically balanced.
Lightning renovation: We replaced all the older, energy-wasting lighting with the new one in LED technology. We replaced 682 lamps.

Contractually guaranteed results

Baseline: 116.97 kWh/m^{2}a
Condition after the renovation: we lowered the energy number to 48.35 kWh/m^{2}a

The retrofit of the Kolezija Primary School building on Splitska Street was extremely expeditious with the generous support and attention of the City of Ljubljana and all the contractors, which made all of us at Kolezija Primary School extremely happy. After moving into the comprehensively retrofitted building, we soon realised that we feel good in the renovated building and that this space allows us everything that a school space should provide. In beautiful, bright, renovated rooms, we have enough space for relaxed socialising, and modernly arranged classrooms allow us to hold high-quality lessons.
After the retrofit, the building is suitable for the education of our oldest students, who already feel at home in the new building.

***Nina Triler**, principal of Kolezija Primary School*

Comprehensive energy retrofits of buildings

Martin Krpan Primary School

Name	Martin Krpan Primary School
Address	Gašperšičeva ulica 10, 1000 Ljubljana
Year of construction	1982

As part of the Energy Retrofit of Ljubljana project, we comprehensively retrofitted the building.

Baseline

The building envelope of the facility and the ceiling above the basement and attic were insufficiently insulated according to the currently valid guidelines, and old wooden joinery was installed. The heating station needed renovation, the radiator heating did allow for local regulation, but it was hydraulically unbalanced. The lighting was mostly done in fluorescent technique with classic ballasts.

The building was in a poor state of energy efficiency.

Start of works: July 2021

Completion of works: April 2022

Investment value: € 1,083,373.10

today

Implemented measures of comprehensive energy retrofit

Building envelope: We thermally insulated the entire facade in with insulation material thickness to meet the Regulations requirements. Additionally, we insulated the ceiling towards the attic of the building with mineral wool and vapor-permeable foil.
Builders' joinery: We replaced the old, energy-wasting builders' joinery with the new one, including internal and external shelves, and added external blinds.
Heating system: We installed new distributors, a new boiler and new thermostatic heads, and we hydraulically balanced the system.
Renovation of ventilation: We removed the old energy-inefficient ventilation system of the small and large gym and replaced it with a new energy-efficient system.
Lightning renovation: We replaced all the older, energy-wasting lighting with the new one in LED technology. We replaced 646 lamps, upgraded 22 sensors for turning on the lights, and upgraded the DALI system for smart lighting control in 40% of the facility.
Energy management: We introduced energy monitoring at the facility, through which we monitor the energy consumption in the facility and thus the achievement of the set goals (savings).

At the Martin Krpan Primary School, the energy retrofit was carried out as part of the comprehensive renovation of the school. The school got new electrical wiring, room lighting, a heating station and, of course, a facade. The beautiful, bright external image of the school catches the eye. Visitors are surprised by the lights in the corridors, which are switched on and off by sensors. We hope that the thermal efficiency will withstand the test of the wintertime, when the thermal station will also operate at full heating capacity and thus lower financial costs.

We are happy and grateful to the City of Ljubljana that we were among the first retrofitted schools in Ljubljana.

***Barbara Žitnik Ternovec**,*
the principal of Martin Krpan Primary School

Contractually guaranteed results

Baseline: 201.35 kWh/m^{2}a
Condition after the renovation: the energy number was reduced to 157.19 kWh/m^{2}a

Comprehensive energy retrofits of buildings

Trnovo Primary School

Name	Trnovo Primary School
Address	Karunova ulica 14a, 1000 Ljubljana
Year of construction	1962

As part of the Energy Retrofit of Ljubljana project, we comprehensively retrofitted the building.

Baseline

The building envelope of the facility was insufficiently insulated. The facility had old wooden builders' joinery. The heating station needed renovation, the radiator heating did allow for local regulation, but it was hydraulically unbalanced. The gyms were not sufficiently ventilated and lit. The lighting was mostly done in fluorescent technique with classic ballasts.

The building was in a poor state of energy efficiency.

Start of works: August 2021

Completion of works: April 2022

Investment value: € 1,585,228.40

today

Implemented measures of comprehensive energy retrofit

Building envelope: We thermally insulated the entire facade.
Construction of the facade under the ground: We removed the floors, installed XPS, waterproofing and reinstalled the cleaned exterior floors.
Builders' joinery: We replaced the old energy-wasting joinery with new one and installed manually operated external blinds.
Roof insulation: We thermally insulated the pitched and flat roofs, removed the old layers, added foil and a new sheet metal covering with the production of all finishes and borders.
Ventilation of the facility: We replaced the ventilation system in the gym with heat recovery and the installation of a new pipe distribution system.
Heating system: We installed new natural gas boilers with all the necessary hydraulic equipment and installations. We added an air-water heat pump. New thermostatic valves and heads were installed on the radiator heating and the heating system was hydraulically balanced.
Lightning renovation: We replaced all the older, energy-wasting lighting with the new one in LED technology. We replaced 612 lamps, upgraded 20 sensors for turning on the lights, and upgraded the DALI system for smart lighting control in 40% of the facility. We also replaced 33 reflectors with LED technology in the gym.
Energy management: We introduced energy monitoring at the facility, through which we monitor the energy consumption in the facility and thus the achievement of the set goals (savings).

Contractually guaranteed results

Baseline: 102.64 kWh/m^{2}a
Condition after the renovation: we lowered the energy number to 71.38 kWh/m^{2}a

The Trnovo Primary School building, which is 60 years old, was comprehensively retrofitted in the period June 2021 – January 2022, in terms of structural integrity, energy and fire protection. A lot of effort was put into the renovation by the City of Ljubljana, all contractors, as well as our employees and pupils, who during that time had to be at three different locations in Ljubljana, but the school became much safer and more economical. All of us who enter the school premises – students, employees, parents and other visitors – are gratefully aware of this.

Đulijana Juričić, MSc, *on behalf of the collective and pupils of the Trnovo Primary School*

Comprehensive energy retrofits of buildings

Rihard Jakopič Primary School

Name	Rihard Jakopič Primary School
Address	Derčeva ulica 1, 1000 Ljubljana
Year of construction	1964

As part of the Energy Retrofit of Ljubljana project, we comprehensively retrofitted the building.

Baseline

The building envelope of the facility was insufficiently insulated according to the currently valid guidelines, and it had old wooden ALU builders' joinery. The heating station needed renovation, the radiator heating did allow for local regulation, but it was hydraulically unbalanced. The lighting was mostly done in fluorescent technique with classic ballasts.

The building was in a poor state of energy efficiency.

Start of works: May 2021

Completion of works: August 2021

Investment value: € 705,885.90

today

Implemented measures of comprehensive energy retrofit

Building envelope: We thermally insulated all facades of the building that were not planned for demolition. We installed thermal insulation in accordance with the Regulations standard.
Insulation of the facade below the ground: We removed the floors, installed XPS, waterproofing and reinstalled the cleaned exterior floors.
Builders' joinery: We replaced the old energy-wasting joinery with new, where it was not intended for demolition, and installed manually operated external blinds. We installed new PVC windows, in accordance with the Regulation.
Heating system: We renovated the station for central heating and heating of sanitary water. New thermostatic valves and heads were installed on the radiator heating and the heating system was hydraulically balanced.
Lightning renovation: We replaced most of the older, energy-wasting lighting with new lighting in LED technology. We replaced 400 lamps.
Energy management: We introduced energy monitoring at the facility, through which we monitor the energy consumption in the facility and thus the achievement of the set goals (savings).

Contractually guaranteed results

Baseline: 102.64 kWh/m^{2}a
Condition after the renovation: we lowered the energy number to 71.38 kWh/m^{2}a

On the occasion of the complete renovation of the school, our pupils, very happy with this acquisition, reworked Prešeren's well-known poem The Water Man (Povodni mož).
We thank you very much for the renovated school with the following verses:
Though long for its beautiful schools Ljubljana was known,
Than ours there never was any more fair,
No schools were known anywhere,
None, neither new nor renovated.
Since the construction service came,
Wider smiles Rihard Jakopič has had.
Your staircases to knowledge are pathways.
Many truths realised were here,
Many pupils ventured into the world.
Beautiful facade, floors and basement,
This is the most beautiful school in the world!

***Dobrila Lazović**, principal of the Rihard Jakopič Primary School*

Comprehensive energy retrofits of buildings

Zalog Primary School

Name	Zalog Primary School
Address	Cerutova ulica 7, 1000 Ljubljana
Year of construction	1973

As part of the Energy Retrofit of Ljubljana project, we comprehensively retrofitted the building.

Baseline

The building envelope of the facility was insufficiently insulated. Old wooden joinery had been installed, and the roof domes were also dilapidated. The heating station needed renovation, the radiator heating did allow for local regulation, but it was hydraulically unbalanced. The kitchen had decrepit ventilation and the gym had poor lighting. The lighting was mostly done in fluorescent technique with classic ballasts.

The building was in a poor state of energy efficiency.

Start of works: October 2021

Completion of works: March 2022

Investment value: € 978,953.10

today

Implemented measures of comprehensive energy retrofit

Building envelope: We thermally insulated the entire facade, while preserving the appearance of the brick facade in some places.
Construction of the facade under the ground: We removed the floors, installed XPS, waterproofing and reinstalled the cleaned exterior floors.
Builders' joinery: We replaced the old energy-wasting builders' joinery with the new one, and we also replaced the skylights and roof domes.
Roof insulation: We thermally insulated the pitched and flat roofs, removed the old layers, added foil and a new sheet metal covering with the production of all finishes and borders.
Heating system: We renovated the station for central heating and heating of sanitary water. New thermostatic valves and heads were installed on the radiator heating and the heating system was hydraulically balanced.
Kitchen ventilation: We rehabilitated the ventilation in the kitchen with the installation of a new ventilation system and duct distribution, as well as connection to the remote control.
Lightning renovation: We replaced all the older, energy-wasting lighting with the new one in LED technology. We replaced 419 lamps, upgraded 14 sensors for turning on the lights and the DALI system for smart lighting control in 40% of the building. We also replaced 30 reflectors with LED technology in both gyms.
Energy management: We introduced energy monitoring at the facility, through which we monitor the energy consumption in the facility and thus the achievement of the set goals (savings).

Contractually guaranteed results

Baseline: 140.11 kWh/m^{2}a
Condition after the renovation: we lowered the energy number to 103.91 kWh/m^{2}a

Zalog Primary School was energy-retrofitted as part of a comprehensive renovation at the beginning of 2022. After only a few weeks, the first results were apparent. In the cold part of the year, the school is warmer with a lower energy input, and in the warm part it is cooler than before the renovation. Among other things, the new insulation of the entire school and the replacement of windows contribute decisively to this. The remote control of the heat pump greatly simplifies the regulation of suitable temperature conditions for undisturbed school work. All the lamps were also replaced. Their operation automatically adapts to the natural light in the room.

***Andrej Krumpak**, principal of the Zalog Primary School*

Comprehensive energy retrofits of buildings

Vič Kindergartens – Rožna dolina branch

Name	Vič Kindergartens – Rožna dolina branch
Address	Cesta 27. aprila 12, 1000 Ljubljana
Year of construction	1982

As part of the Energy Retrofit of Ljubljana project, we comprehensively retrofitted the building.

Baseline

The building envelope of the facility was insufficiently insulated. The facility had old wooden builders' joinery. The thermal station needed renovation, the radiator heating did allow for local regulation, but it was hydraulically unbalanced and without thermostatic valves. The lighting was mostly done in fluorescent technique with classic ballasts.

The building was in a poor state of energy efficiency.

Start of works: June 2021

Completion of works: January 2022

Investment value: € 542,634.80

today

Implemented measures of comprehensive energy retrofit

Building envelope: We thermally insulated the entire facade.
Builders' joinery: We replaced the old energy-wasting joinery with new one and installed manually operated external blinds.
Roof insulation: We thermally insulated the pitched roof, removed the old layers, added foil and a new sheet metal covering with the production of all finishes and borders.
Heating system: We upgraded the existing distributor with temperature sensors and gauges and a new water heater with all the necessary installation. We connected the new heat pump to the existing boiler room. New thermostatic valves and heads were installed on the radiator heating and the heating system was hydraulically balanced.
Lightning renovation: We replaced all the older, energy-wasting lighting with the new one in LED technology. We replaced 226 lamps, upgraded 14 sensors for turning on the lamps and the DALI system for smart lighting control in 40% of the building.
Energy management: We introduced energy monitoring at the facility, through which we monitor the energy consumption in the facility and thus the achievement of the set goals (savings).

As adults in kindergarten, we are always focused on relationships. On relationships with children, with families, with each other and on relationships with all stakeholders who enter this shared space of ours. And so, even during the comprehensive energy, functional and aesthetic renovation of the Rožna Dolina branch, a large and collaborative team considered how to connect this important living space to the pulse and dynamics of the house and its location in the Rožnik Forest Park.
After staying in the renovated premises for a little more than six months, we can definitely say that this beautiful city, Rožna dolina, kindergarten house breathes well and we live well in it.

***Barbara Požun**, principal of the Vič kindergartens*

Contractually guaranteed results

Baseline: 164.71 kWh/m^{2}a
Condition after the renovation: we lowered the energy number to 115.01 kWh/m^{2}a

Comprehensive energy retrofits of buildings

Livada Primary School

Name	Livada Primary School
Address	Ulica Dušana Kraigherja 2, 1000 Ljubljana
Year of construction	1993

As part of the Energy Retrofit of Ljubljana project, we comprehensively retrofitted the building.

Baseline

The heating station and heating source needed renovations, the radiator heating did allow for local regulation, but was hydraulically unbalanced and without thermostatic heads. The dining room and gym were poorly ventilated, and the gym was also poorly lit. The lighting in the facility was mostly done in fluorescent technique with classic ballasts.

The building was in a poor state of energy efficiency.

Start of works: July 2021

Completion of works: May 2022

Investment value: € 911,953.20

today

Implemented measures of comprehensive energy retrofit

Building envelope: The facade was thermally insulated.
Roof insulation: We thermally insulated the pitched roof, removed the old layers, added foil and a new roofing with the creation of all finishes and borders. We also insulated the flat roof anew.
Heating system: We converted the existing boiler room to meet the needs of connecting a new heat pump, and upgraded the system by installing temperature sensors and gauges for six heating branches. New thermostatic valves and heads were installed on the radiator heating and the heating system was hydraulically balanced.
Ventilation of the facility: We installed a new ventilation system for the dining room and gym, and reworked the existing duct and pipe distribution and connected it to remote control.
Lightning renovation: We replaced all the older, energy-wasting lighting with the new one in LED technology. We replaced 384 lamps, upgraded 12 sensors for switching on the lamps and the DALI system for smart lighting control in 40% of the building. In both gyms, we replaced 24 reflectors with newer ones in LED technology.
Energy management: We introduced energy monitoring at the facility, through which we monitor the energy consumption in the facility and thus the achievement of the set goals (savings).

Contractually guaranteed results

Baseline: 116.02 kWh/m^{2}a
Condition after the renovation: we lowered the energy number to 79.30 kWh/m^{2}a

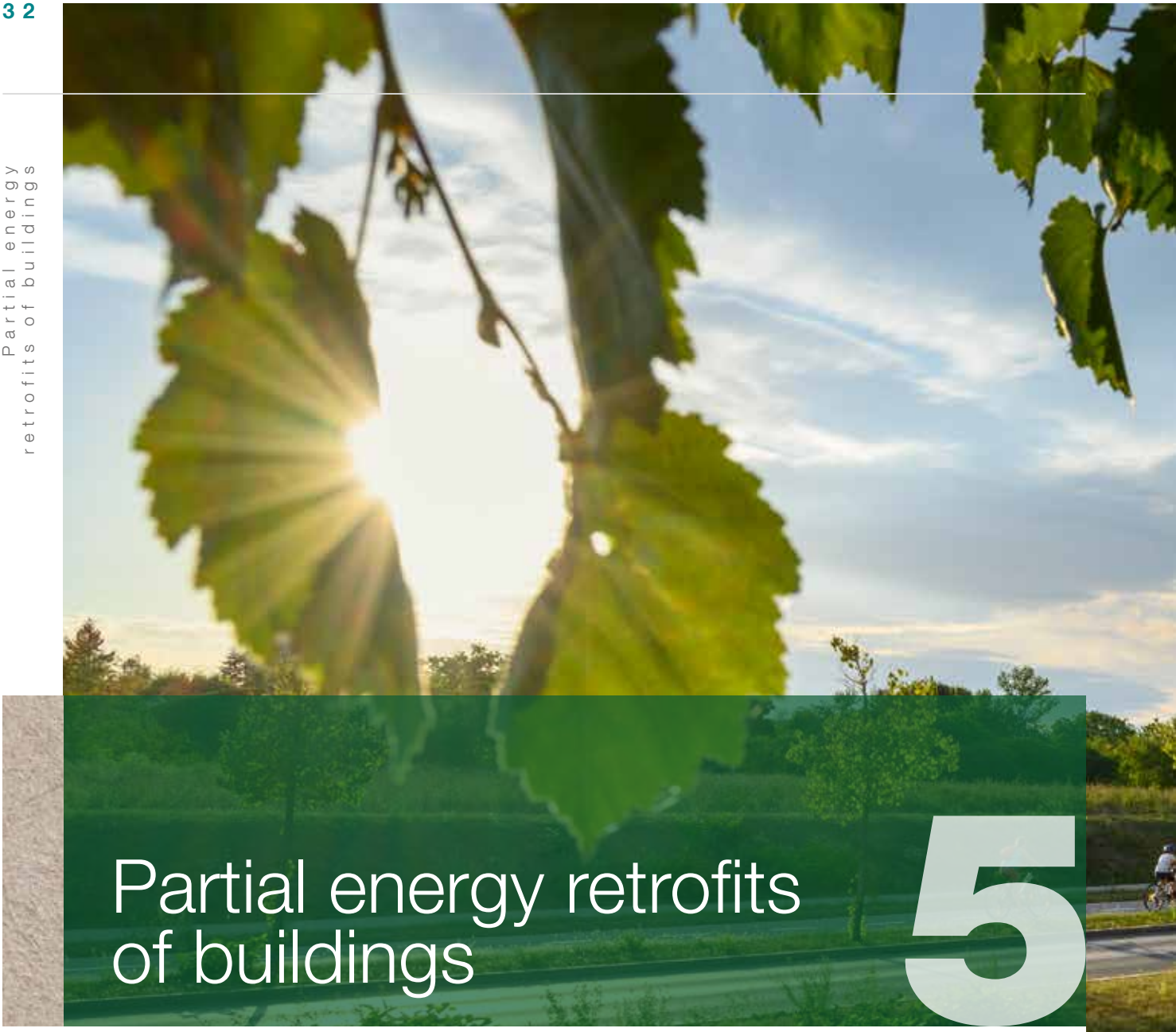
How different it is to learn and acquire new knowledge in our renovated, more beautiful Livada school.
The newly equipped premises are waiting for even better quality work and successes, the bustle of children and their smiles.
The City of Ljubljana, we are very grateful and thank you very much!

***Vlasta Kunst**, administrative secretary at Livada Primary School*

Comprehensive energy retrofits of buildings

Facility	Address
Janez Levec Centre Ljubljana – Karlovška	Karlovška cesta 18, 1000 Ljubljana
Kolezija Primary School, location Splitska	Splitska ulica 13, 1000 Ljubljana
Martin Krpan Primary School	Gašperšičeva ulica 10, 1000 Ljubljana
Trnovo Primary School	Karunova ulica 14a, 1000 Ljubljana
Rihard Jakopič Primary School	Derčeva ulica 1, 1000 Ljubljana
Zalog Primary School	Cerutova ulica 7, 1000 Ljubljana
Vič Kindergartens – Rožna dolina branch	Cesta 27. aprila 12, 1000 Ljubljana
Livada Primary School	Ulica Dušana Kraigherja 2, 1000 Ljubljana

Investment amount	Energy consumption before the retrofit (kWh/m²a)	Energy consumption after the retrofit (kWh/m²a)
€ 418,236.50	188.46	144.56
€ 1,248,436.80	116.97	48.35
€ 1,083,373.10	201.35	157.19
€ 1,585,228.40	102.64	71.38
€ 705,885.90	109.36	76.80
€ 978,953.10	140.11	103.91
€ 542,634.80	164.71	115.01
€ 911,953.20	116.02	79.30



Partial energy retrofits of buildings

5

In the Energy Retrofits of Ljubljana project, we included additional five buildings in the City of Ljubljana, which were partially energy retrofitted as part of a public-private partnership based on the energy contracting model.

We partially retrofitted Miško Kranjec Primary School, Vič Primary School, Pedenjped Kindergarten – Učenjak branch, Trnovo Kindergarten and Šentvid Kindergarten – Sapramiška branch. We installed thermostatic valves in the facilities and carried out hydraulic balancing of the heating system, renovated the heating sources with the option of adding an additional renewable energy source (air/water, water/water or earth/water heat pump) and renovated the lighting (LED technology).

5
partially
energy retrofitted facilities

1,300,000
EUR
Investment value

14,150
m²
total renovated area

114 **tonnes**
less emissions
CO_2 (eq)

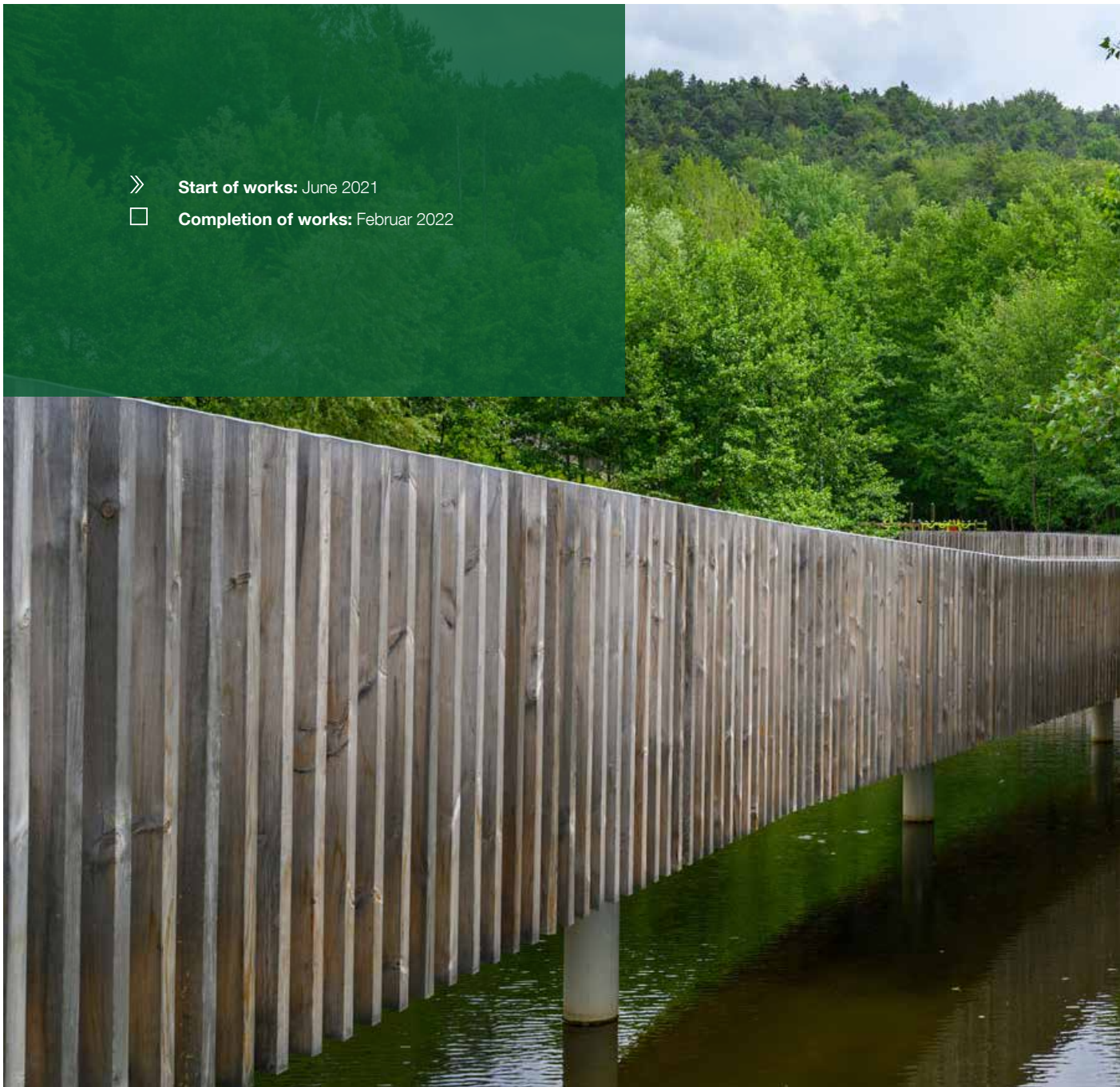
5,500
average-sized trees

Partial energy retrofits of buildings

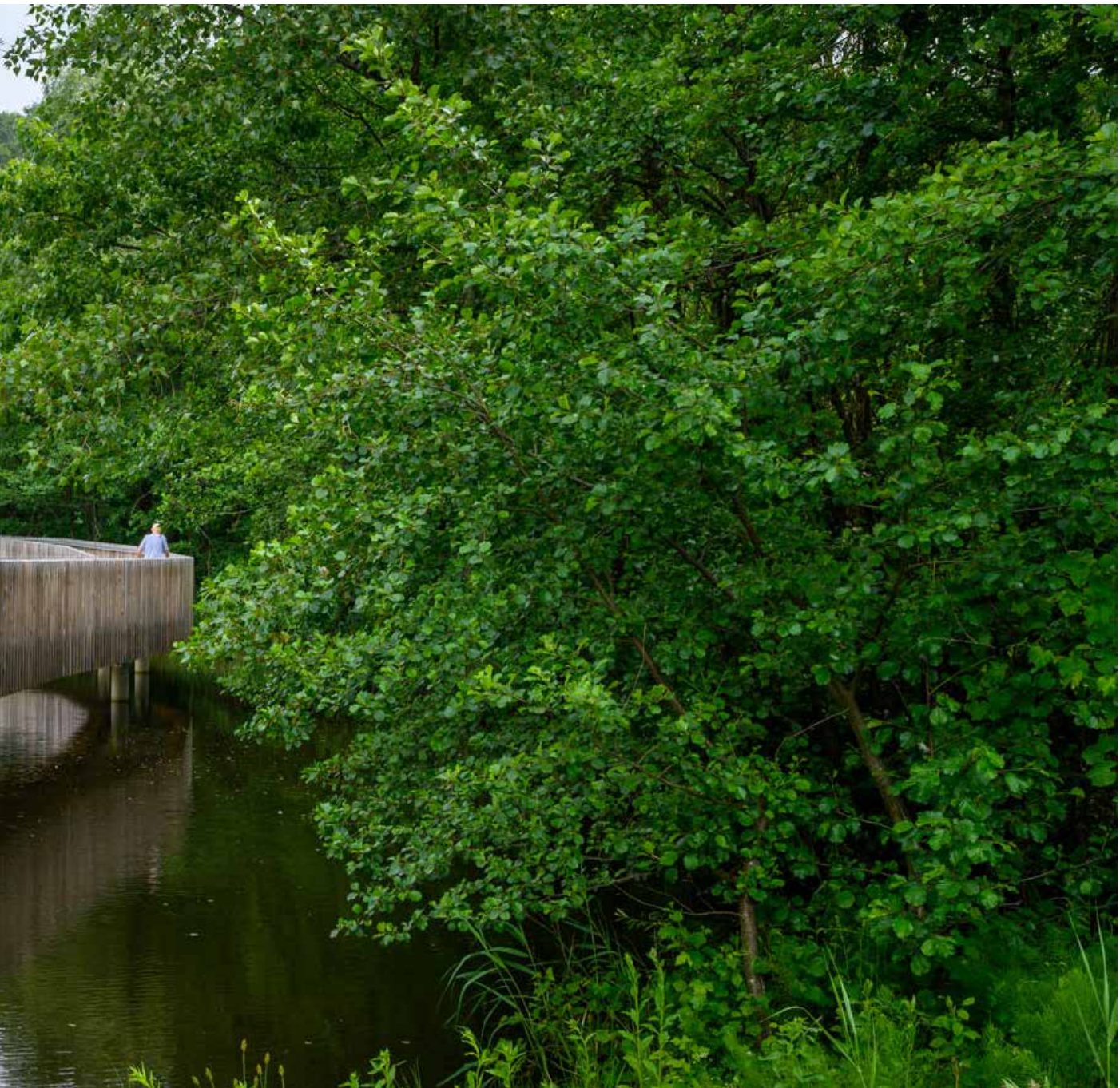
Facility	Address
Miško Kranjec Primary School	Kamnogoriška cesta 35, 1000 Ljubljana
Vič Primary School	Abramova ulica 26, 1000 Ljubljana
Pedenjped Kindergarten – Učenjak Branch	Cesta II. Grupe odredov 41, 1000 Ljubljana
Šentvid Kindergarten – Sapramiška Branch	Ulica pregnancev 6, 1000 Ljubljana
Trnovo Kindergarten	Kolezijska ulica 11, 1000 Ljubljana

» **Start of works:** June 2021

☐ **Completion of works:** Februar 2022



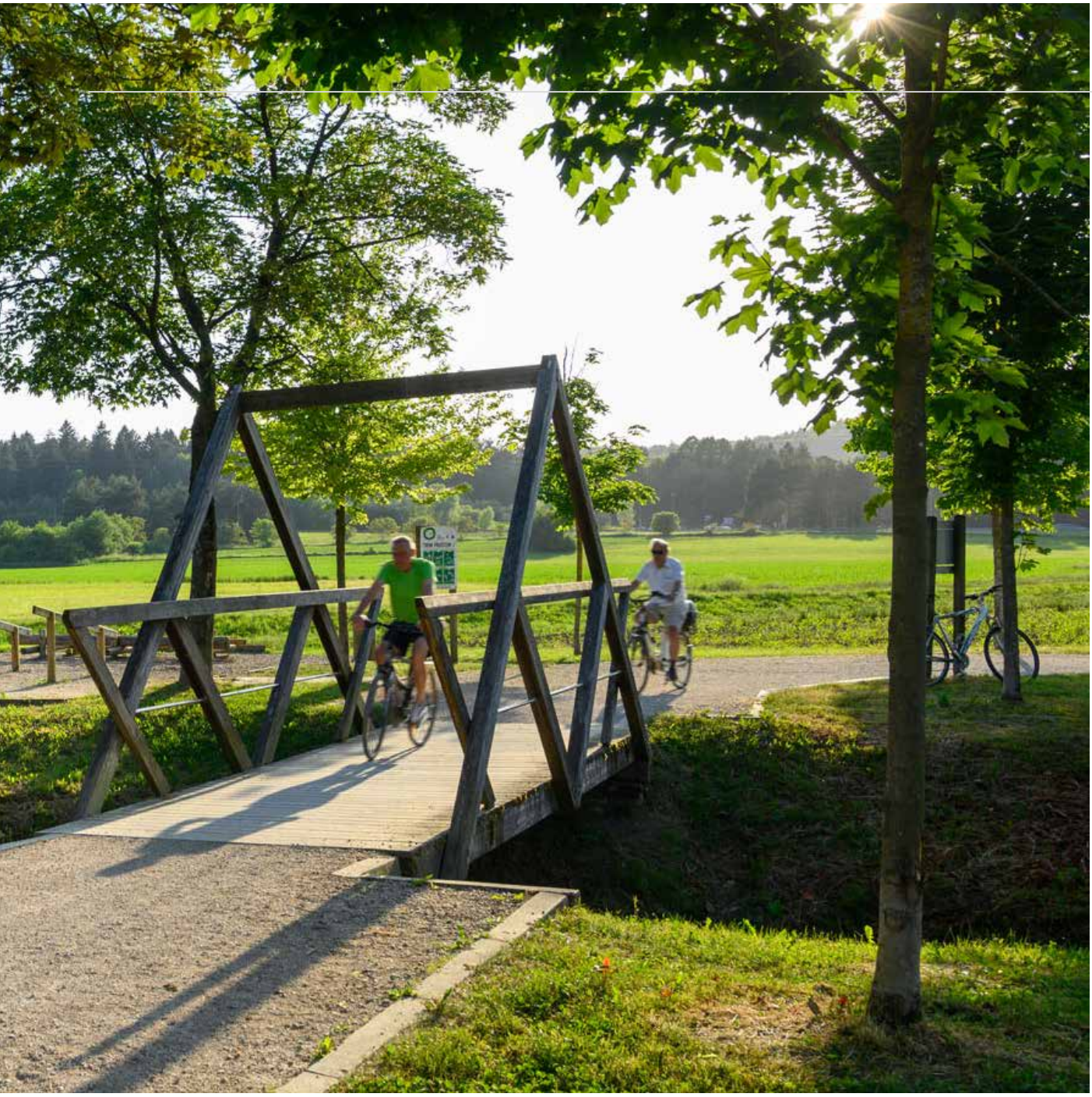
Investment amount	Energy consumption before the retrofit (kWh/m²a)	Energy consumption after the retrofit (kWh/m²a)
€ 281,324.50	99.22	90.65
€ 460,612.00	102.31	93.67
€ 167,460.00	144.14	134.60
€ 202,198.00	217.37	204.11
€ 235,191.00	121.69	113.56



6 The works continue

In 2022, we will continue with the public-private partnership based on the energy contracting principle, as part of which we will renovate 5 buildings. We will complete the project in 2023.

As part of the first phase of the fourth public-private partnership, we will comprehensively retrofit three facilities. For comprehensive retrofits, we will use funds from the Cohesion Fund. In addition, we will partially retrofit two buildings, namely we will replace inefficient lighting with modern LED technology.

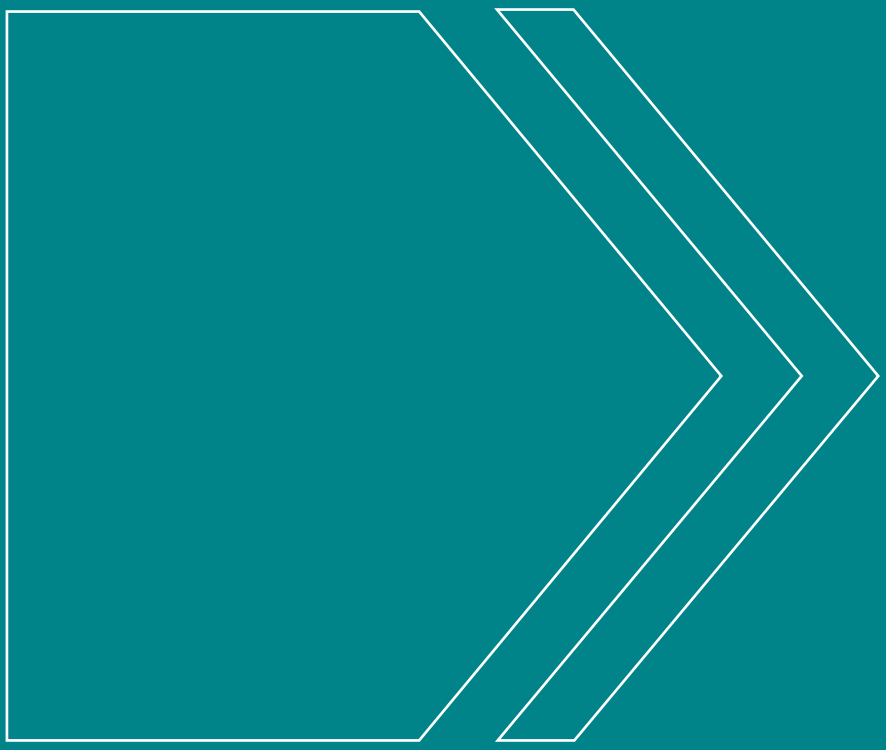


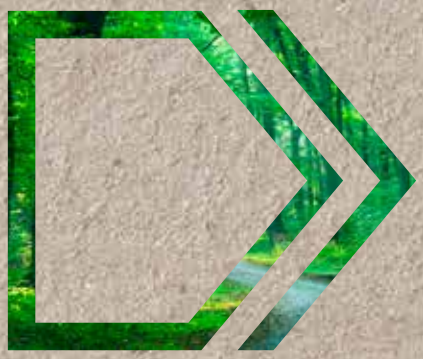
Comprehensive energy retrofits:

Savsko naselje Primary School
Mojca Kindergarten – Kekec Branch
Oton Župančič Kindergarten – Čurimuri Branch

Partial energy retrofits:

Congress Square parking garage
Zalog Ice Hall





Energy
Advanced